Tiragalloite $Mn_4^{2+}As^{5+}Si_3O_{12}(OH)$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As grains, which may be elongated, to 1.5 mm; also as aggregates. *Twinning:* On {100}.

Physical Properties: *Cleavage:* Good on {100}; a distinct parting, normal to elongation. Hardness = n.d. D(meas.) = 3.84(6) D(calc.) = 3.829

Optical Properties: Transparent to translucent. *Color:* Orange, brownish orange; orange to yellow in thin section. *Luster:* Subadamantine.
Optical Class: Biaxial (+). *Orientation:* $X \simeq a$; $Y = b$; $Z \simeq c$. *Dispersion:* Inclined.
$\alpha = 1.745(5)$ $\beta = 1.751(3)$ $\gamma = 1.760(5)$ 2V(meas.) = 38°–46°

Cell Data: *Space Group:* $P2_1/n$. $a = 6.66(1)$ $b = 19.92(2)$ $c = 7.67(1)$ $\beta = 95.7(1)°$
Z = 4

X-ray Powder Pattern: Molinello mine, Italy.
3.258 (100), 3.151 (73), 3.034 (72), 3.003 (72), 2.608 (65), 2.489 (58), 2.736 (54)

Chemistry:

	(1)	(2)
SiO_2	32.38	31.91
TiO_2		0.02
Al_2O_3		0.02
As_2O_5	16.07	18.35
V_2O_5	1.67	
FeO	0.17	0.56
MnO	48.34	46.02
MgO		0.00
CaO	0.75	0.75
Na_2O		0.03
K_2O		< 0.01
Total	99.38	97.67

(1) Molinello mine, Italy; by electron microprobe, average of 28 analyses; corresponds to $(Mn^{2+}_{3.91}Ca_{0.08}Fe_{0.01})_{\Sigma=4.00}(As^{5+}_{0.84}V^{5+}_{0.12})_{\Sigma=0.96}Si_3O_{12}(OH)$. (2) Ködnitz Valley, Austria; by electron microprobe, average of 15 analyses; corresponds to $(Mn^{2+}_{3.66}Ca_{0.08}Fe_{0.04}Na_{0.01})_{\Sigma=3.79}$ $As^{5+}_{0.90}Si_{3.00}O_{12}(OH)$.

Occurrence: In veinlets cutting massive aggregates of braunite and quartz (Molinello mine, Italy); in manganese-rich lenses in quartzitic chlorite schists probably derived from marine sediments (Ködnitz Valley, Austria).

Association: Quartz, manganoan calcite, parsettensite, albite, medaite (Molinello mine, Italy); tephroite, pyroxmangite, rhodonite, spessartine, rhodochrosite (Ködnitz Valley, Austria).

Distribution: From the Molinello manganese mine, Val Graveglia, near Chiavari, Liguria, Italy. In the Ködnitz Valley, Tirol, Austria.

Name: For Paolo Tiragallo (1905–), amateur mineralogist of Liguria, Italy.

Type Material: University of Rome, Rome, 24314; Municipal Museum of Natural History, Milan, Italy; University of Oslo, Oslo, Norway.

References: (1) Gramaccioli, C.M., W.L. Griffin, and A. Mottana (1980) Tiragalloite, $Mn_4[AsSi_3O_{12}(OH)]$, a new mineral and the first example of arsenatotrisilicate. Amer. Mineral., 65, 947–952. (2) Gramaccioli, C.M., T. Pilati, and G. Liborio (1979) Structure of a manganese(II) arsenatotrisilicate, $Mn_4[AsSi_3O_{12}(OH)]$: the presence of a new tetrapolyphosphate-like anion. Acta Cryst., 35, 2287–2291. (3) Albrecht, J. (1990) An As-rich manganiferous mineral assemblage from the Ködnitz Valley (Eastern Alps, Austria): geology, mineralogy, genetic considerations, and implications for metamorphic Mn deposits. Neues Jahrb. Mineral., Monatsh., 363–375.